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Indian Standard

IS 8110 : 2019

जल कूप छन्नक जाली एवं खाँचदार पाईप — विशिष्टि

(तीसरा पुनरीक्षण)

Water Well Screens and Slotted Pipes — Specification

(Third Revision)

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भारतीय मानक ब्यूरो
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May 2019 **Price Group 7**

Diamond Core and Water Well Drilling Sectional Committee, MED 21

FOREWARD

This Indian Standard (Third Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Diamond Core and Water Well Drilling Sectional Committee had been approved by the Mechanical Engineering Division Council.

This standard was first published in 1976 and subsequently revised in 1985 and 2000. In this revision, following modifications are made:

a) Terminology, type of screen and slotted pipes, description modified;
b) Pipe thickness in Table 2 aligned with latest IS 4270 'Steel tubes used for water wells (*third revision*)'; and
c) More brass screen sizes for pipe 40, 50, 80 and 100 NB diameter is added in Table 5B.

This edition incorporates Amendment No. 1 (May 2002). The well screen is the most critical element of tube well affecting its life, pump maintenance and efficiency.

Un-plasticized Polyvinyl Chloride (uPVC) screen and casing pipes for bore/tube wells are covered in IS 12818 : 1992 (*first revision*).

In formulation of this standard considerable assistance has been derived from the following standards:

ANSI/AWWA, A100-90 Water wells

AISI – 304 : 1963 Stainless and heat resisting steels

The composition of the committee responsible for the formulation of this standard is given in Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

WATER WELL SCREENS AND SLOTTED PIPES — SPECIFICATION

(Third revision)

1 SCOPE

This standard specifies the types and the technical requirements of screens and slotted pipes used in tube wells. Further, it gives detailed specifications, selection criterion, testing and inspection methods for wire wound cage type well screens.

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
280 : 2006	Mild steel wire for general engineering purposes (*fourth revision*)
3168 : 1981	Specification for brass strip and foil for deep drawing (*first revision*)
1239 (Part 1) : 2004	Steel tubes, tubulars and other wrought steel fittings: Part 1 Steel tubes — Specifications (*sixth revision*)
4270 : 2001	Steel tubes used for water wells — Specifications (*third revision*)
4412 : 1981	Specification for copper wires for general engineering purposes (*first revision*)
6528 : 1995	Stainless steel wire — Specifications (*first revision*)
6911 : 2017	Stainless steel plate, sheet and strip — Specification (*second revision*)
7887 : 1992	Mild steel wire rod for general engineering purposes — Specifications (*first revision*)
10500 : 2012	Drinking water — Specification (*second revision*)
10151 : 1982	Specification for polyvinyl chloride (PVC) and its copolymers for its safe use in contact with foodstuffs, pharmaceuticals and drinking water

NOTE — Brass strips as per IS 3168 for making brass screens, in which lead (Pb) content is lower (0.05 percent to 0.10 percent) may be used. In case of water wells for drinking water purposes, the quality of water should be as laid down in IS 10500.

3 TERMINOLOGY

3.1 Well Screens — A filtering device that serves as the intake portion of tube wells constructed in unconsolidated or semi-consolidated aquifers to permit water to enter the well structure. It is a filtering device used to prevent sediments from entering a water well.

3.2 Screens — Specifically fabricated filter pipes made from different materials.

3.3 Slot Opening — Width of the opening of the slot – least dimension of the slot (opening) on pipe.

3.4 Percentage Open Area — Open area of the slots as percentage of total outside surface area of pipe.

3.5 Profile Wire — Shaped wire which is spirally wound around support rods.

3.6 Support Rods — The longitudinal shaped or circular rods supporting the profile wire.

3.7 End Rings — Rings or couplers welded at both ends of the screen section.

3.8 Collapse Strength — It is the strength of screen to withstand surrounding hydrostatic pressure on outside surface.

3.9 Tensile Strength — It is the strength of the screen to withstand tensile load.

3.10 Push Strength — Maximum separating force that weld joint between profile wire and support rod can withstand.

3.11 Penetration — It is the amount of penetration between profile wire and support rod after fusion welding.

3.12 Screen Clogging — Blockage of slots by gravel or aquifer material.

3.13 Entrance Velocity — Highest velocity at which water enters the well through screen or slotted pipe.

3.14 Laminar Flow — Water flow in which the stream line remain distinct and in which the flow direction at every point remain unchanged with time.

4 TYPES

4.1 The following are the various types of well screen based on the shape of the slot design:

a) Slotted pipes	Type A
b) Bridge slots	Type B
c) Mesh wrapped screens	Type C
d) Cage type wire-wound screens	Type D
e) Pre-packed resin bounded gravel screens	Type E

4.2 Brief Description

a) *Slotted pipes* — These are pipes with rectangular cut slots, however, in case of brass screen slots are cut on sheets before rolling into pipes.

b) *Bridge slotted pipes* — Slots are not cut but are pressed or punched out in vertical direction.

c) *Mesh wrapped screen* — These are made by wrapping copper mesh over perforated steel pipe using spacers about 3 mm thick in between the copper mesh and perforated pipe.

d) *Cage type wire wound screen* — These are special type of screens where in a continuous shaped profile wire is spirally wound around series of longitudinal support rods of circular or shaped section with each intersection of profile wire and support rod welded by electric resistance fusion welding process. The longitudinal support rods are welded to end rings at both ends to facilitate joining with casing pipes or other screens by butt welding or threading.

e) *Pre-packed resin bonded gravel screens* — Suitable grade gravel is pasted on the slotted pipe with the help of resin type adhesive material.

5 MATERIALS

5.1 The well screens and slotted pipes shall be made of either corrosion-resistant material or steel pipes having sufficient thickness to guard against the effect of corrosion and to ensure reasonable life of tube well. The following are the recommended materials for various types of well screens and slotted pipes:

a) Low carbon (*see* IS 7887) or mild steel (*see* IS 4270);

b) Steel pipes for water and sewage (*see* IS 3589);

c) Specification for cold rolled brass sheet, strip (*see* IS 3168);

d) Fibre glass reinforced or epoxy;

e) PVC (*see* IS 10151);

f) Copper wire (*see* IS 4412);

g) Galvanized steel wire (*see* IS 280);

h) Stainless steel wire (*see* IS 6528);

j) Stainless steel sheets for end rings (*see* IS 6911);

k) Steel tubes, tubulars and other wrought steel fittings:

   Part 1 Steel tubes (*see* IS 1239-Pt-1); and

m) Mild Steel pipes for end rings (*see* IS 4270, IS 3589).

5.2 Suitable material other than those given above which has better properties may also be used as agreed to between the purchaser and the manufacturer.

6 DESIGNATION

The screens shall be designated by the following particulars:

a) Type of well screen, A, B, C, D or E;

b) Nominal bore;

c) Grade/thickness;

d) Slot opening; and

e) Material of screen.

7 BASIC REQUIREMENT OF SCREENS

7.1 Length of Screen

Screens shall be made in 1 m, 1.5 m, 2 m, 3 m, 4 m, 5 m and 6 m in lengths.

7.2 Diameter of Screen

Screens shall be made in 100 mm, 125 mm, 150 mm, 200 mm, 250 mm and 300 mm diameters

7.3 Slot Size

The shapes and size of the slot shall be such that the gravel or aquifer material is not allowed to block the open space. Sharp edges on the periphery of the pipe may offer resistance to flow and hence it is preferable to have smooth rounded edges. The width of the slots as per requirement of the purchaser. It shall be 0.1 mm, 0.15 mm, 0.20 mm, 0.25 mm, 0.50 mm, 0.75 mm, 1.00 mm, 1.5 mm, 2.00 mm and 3.00 mm in spirally wound screens and 1.20 mm, 1.5 mm and 3.00 mm in slotted pipes.

7.4 Shape of Slots

The shape of slot shall be inwardly widening to give no clogging property and shall have minimum geometrical resistance to water flow to reduce frictional head losses.

7.5 Percentage Opening

The percentage open area of slots shall be as high as possible keeping in mind the strength requirement of the screen.

7.6 Distribution of Slots

The slots shall be oriented to get even distribution of flow all over the periphery of the screen pipe. Evenly spaced horizontal slots with least blind spots should be made as far as possible. The slots should be distributed in rows as closely and evenly as possible, staggering the slots between each row.

The screens with evenly spaced continuous horizontal slots (perpendicular to screen axis) throughout the periphery without leaving blind spots are desirable for improved well performance.

7.7 Collapse Strength

Collapse strength should be adequate to with stand pressures developed due to factors like depth of tube well, water level, geological conditions and thickness of gravel pack if any, etc.

7.8 Tensile Strength

The tensile strength of the screen must be able to withstand the weight of the pipe assembly below it.

8 SPECIFIC DESIGN FEATURE

8.1 Slotted Pipes

8.1.1 *Low Carbon or Mild Steel Slotted Pipes*

The slots shall be cut by milling or by slitting saw on the recommended thicknesses of different diameters for various depths of tube well under normal conditions as given in Table 1. Computer numerical control (CNC) based machines to be used for precise slot cutting to maintain high open area and strength of pipe.

8.1.1.1 Typical slot pattern of well screen is shown in Fig. 1 and Fig. 2.

NOTES

1 Mention slot tolerances for various slots for slotted pipes.

2 Dimensional check — With the help of measuring instruments to verify dimensions to be within tolerance limits.

3 Slot opening — With filler gauges: Slot size to be measured for all slots

8.1.1.2 The slots shall not be cut within 12 mm on either side of the longitudinal welded joints of the pipes.

8.1.1.3 The plain space after thread cutting over the larger diameter pipes shall not be less than 150 mm. For elevated handled pipe this space shall be at least 200 mm.

8.1.2 *Fiberglass Reinforced Plastic Pipes (FRP)*

The FRP slotted pipes shall be manufactured by the filament winding process. The slots shall be cut by milling. The slotting pattern (*see* Fig. 3) shall be such as to ensure the minimum cutting of the glass fibre in the pipe and thereby maintaining maximum strength.

8.1.2.1 The recommended thickness of FRP pipes is given as Table 1.

Table 1 Recommended Thickness of FRP Pipes

(*Clause* 8.1.1 and 8.1.2.1)

Sl No.	Well Depth (m)	Thickness of Pipe for Given Diameter (mm)				
		150	200	250	300	350
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	150	5.00	6.00	6.50	8.25	8.50
ii)	300	6.00	6.75	8.00	9.00	9.50

8.1.2.2 The pipes made from FRP based material shall fulfill the requirements as given in Annex A.

8.2 Mesh Wrapped Screens

8.2.1 The pipes used in mesh wrapped screens shall be of mild steel or low carbon steel. The diameter of perforations shall not be less than 12 mm and the distance between the two adjacent holes shall be between 25 and 40 mm depending upon the diameter and the thickness of the pipes used. The pipe thickness shall be same as given in Table 2.

8.2.2 The spacers shall be of mild steel (same material as of pipe) and shall be of thickness 3 mm minimum and shall be 6 mm wide. The distance between the two adjacent spaces shall be 75 mm minimum.

8.2.3 The copper mesh shall be made of copper wire according to IS 4412 and shall not be less than 0.710 mm in thickness.

Table 2 Thickness of Pipes

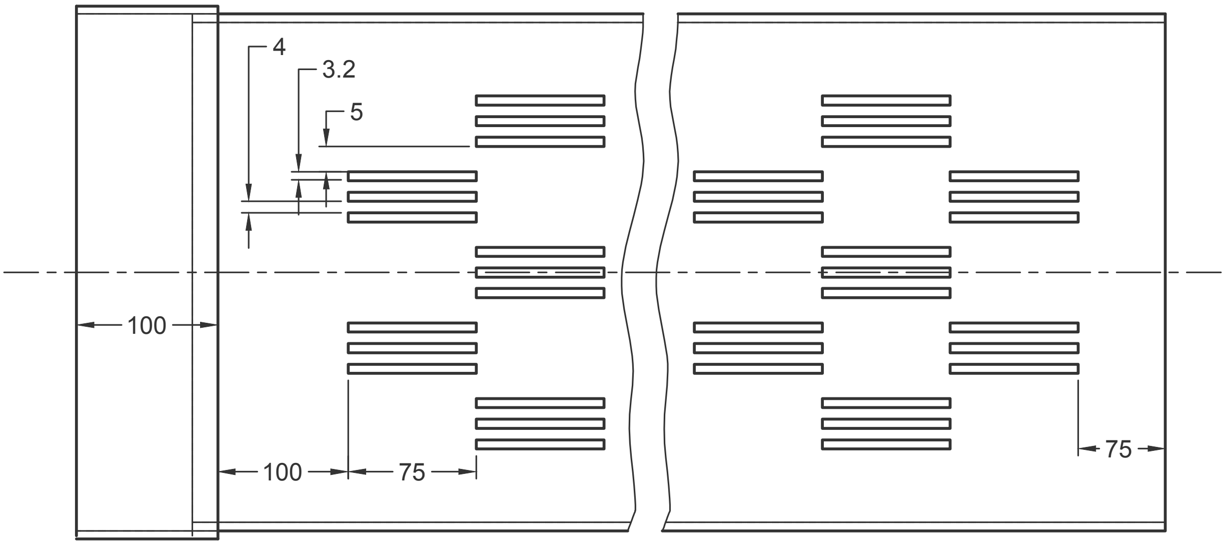
(*Clauses* 8.1.1 and 8.2)

Sl No.	Depth of Well (m)	Thickness of Pipe Size (OD) in mm				
		168.3	219.1	273.1	323.9	355.6
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	50	5.4	6.4	8.0	8.0	10.0
ii)	100	5.4	6.4	8.0	8.0	10.0
iii)	125	5.4	6.4	8.0	8.0	10.0
iv)	150	5.4	6.4	8.0	8.0	10.0
v)	175	5.4	6.4	8.0	8.0	10.0
vi)	200	5.4	6.4	8.0	8.0	10.0
vii)	250	7.1	8.0	10.0	10.0	10.0
viii)	275	7.1	8.0	10.0	10.0	10.0
ix)	300	7.1	8.0	10.0	10.0	10.0

8.3 Cage Type Wire Wound Screen

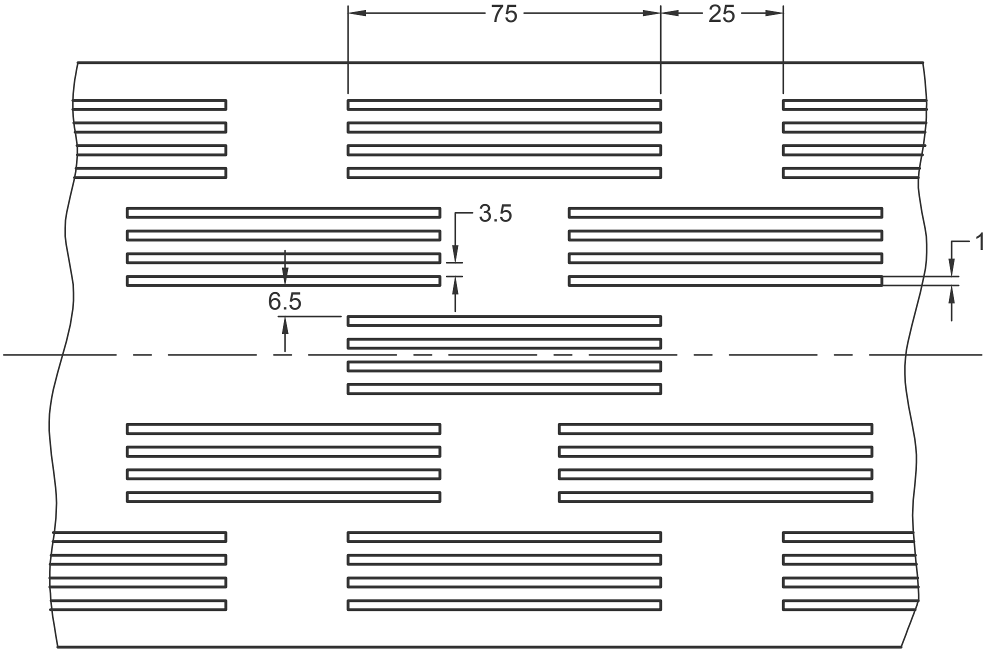
The wrapping wire having a wedge profile with flat surface on the outside and producing expanding slots on the inside. This shape facilitates jetting and back washing operation and also avoids the screens being clogged by fine particles.

The number and cross-section of the vertical support rods and the profile of the wrapping wire shall be such as to give sufficient axial and collapse strength (*see* Fig. 4).



All dimensions in millimetres.

FIG. 1 DEVELOPED VIEW OF A TYPICAL WELL SCREEN, PLAIN SLOTTED TYPE



All dimensions in millimetres.

FIG. 2 SLOTTING ARRANGEMENT

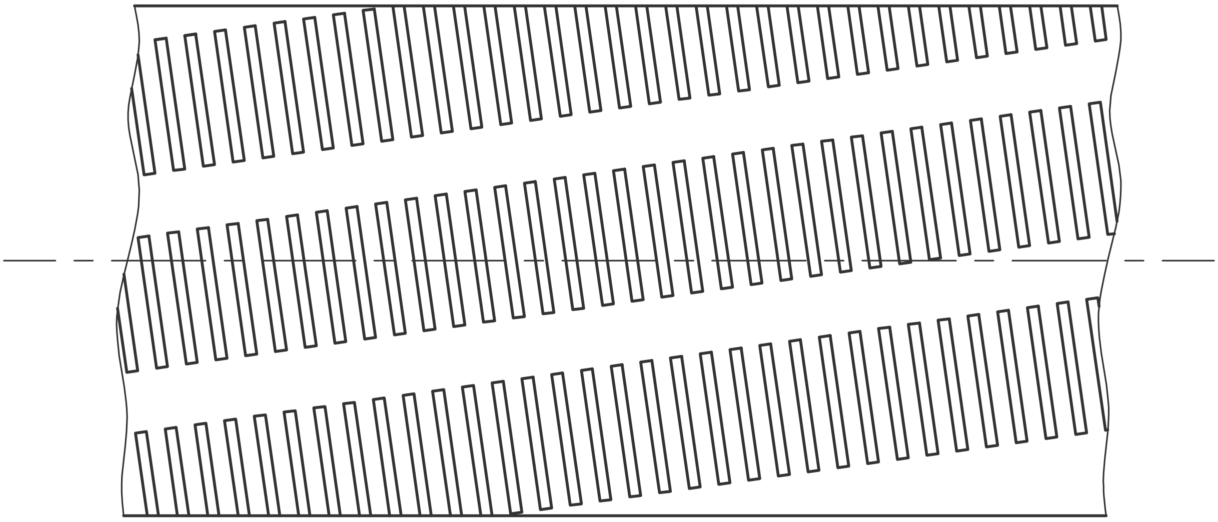
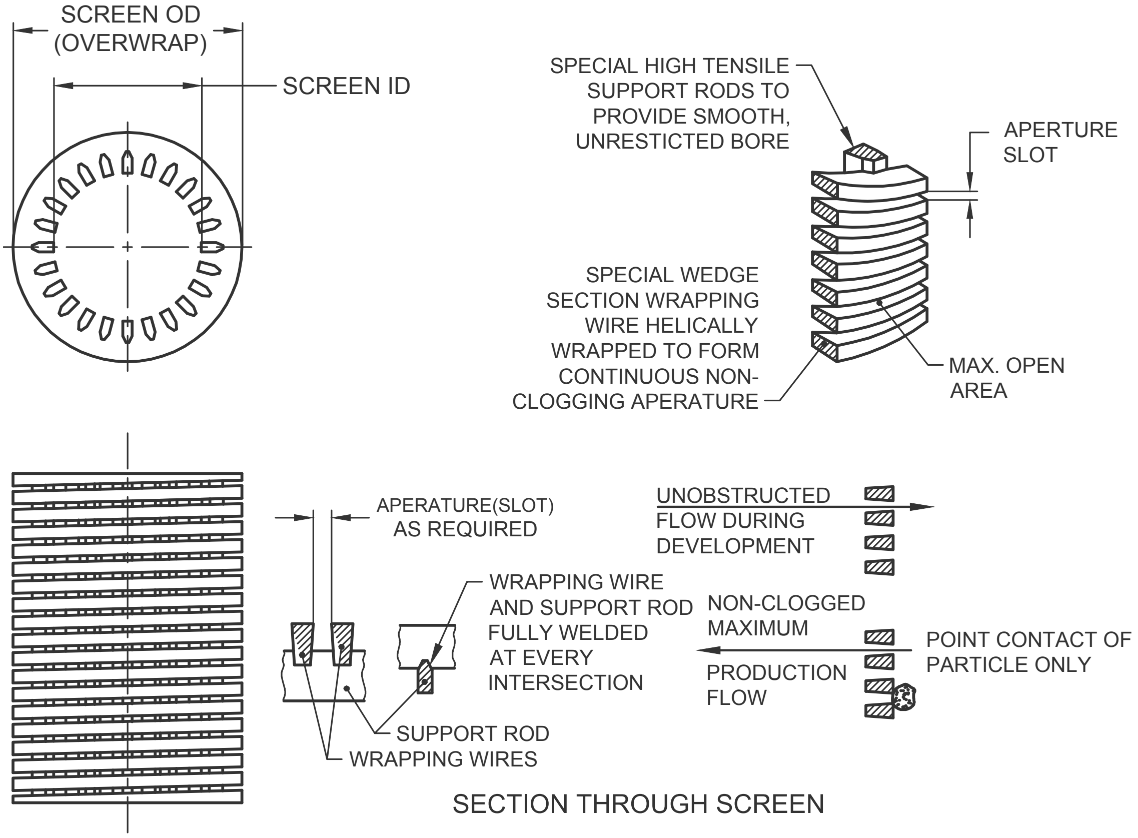


Fig. 3 Recommended Slot Pattern For Frp Pipes



All dimensions in millimetres

Fig. 4 Cage Type Wire Wound Screens

8.3.1 *General Requirements*

8.3.1.1 Electric Resistance Welded (ERW) Cage type Vee Wire Wound Screens shall be of continuous trapezoidal wire spirally wound around fabricated cage (*see* Fig. 4). The screen must consist of 'V' shaped (wedge) profile wire of various dimensions, resistance welded to a cylindrical body made of number of longitudinal special high tensile support rods to provide smooth unrestricted bore which are in turn welded into cylindrical ring couplings at either end.

8.3.1.2 Screen must have evenly distributed continuous slot opening so that it has maximum open area for minimum turbulence and loss of energy.

8.3.1.3 Slot should be smooth, clean edges rounded off so that it gives better hydraulic performance and may reduce the rate of corrosion and encrustation.

8.3.1.4 The inwardly widening slots should be non-clogging so that sediment has only point contact which will give longer effective well life.

8.3.1.5 The wrapping wire having a wedge profile with flat surface on the outside and producing expanding slots on the inside. This shape must facilitate jetting and back washing operation and also avoids the screens being clogged by fine particles.

8.3.1.6 The number and cross-section of the vertical support rods and the size of the wrapping wire shall be such as to give specified tensile and collapse strength.

8.3.1.7 Screen should have inwardly widening slots and available. Slot width to be 0.15 mm, 0.20, 0.25 mm, 0.50 mm, 0.75 mm, 1.00 mm, 1.50 mm, 2.00 mm and 3.00 mm.

8.3.1.8 The overall length of screen shall be 1.0 m, 1.5 m, 2.0 m, 3.0 m, 4.0 m, 5.0 m and 6 m without any circumferential joint in screen section. Screen length is measured between extreme ends of end rings at both ends.

8.3.1.9 Each intersection of wrapping profile wire and support rods shall be fusion welded by electrical resistance welding process to import sufficient joint strength at each joint to sustain development pressures.

8.3.1.10 Since the quality and consistency of strength depends largely upon control of manufacturing process, all the process parameters shall be automatically/ semi automatically controlled to ensure quality and consistency of strength.

8.3.2 *Material of Construction*

8.3.2.1 The screens shall be made from wires of either of the following materials:

a) Low Carbon Galvanized (LCG) steel (*see* IS 280); and

b) Stainless Steel (SS) (*see* designation X04 Cr 18 Ni10 of IS 6528).

8.3.2.2 The screens are classified as regular and heavy depending on their thickness.

8.3.3 *Dimensional Parameters*

The dimensions of screen shall be as given below for two classes and two materials.

8.3.3.1 LCG screens suitable for well depth up to 200 m as given in Table 3.

8.3.3.2 LCG screens suitable for well depth up to 400 m as given in Table 4.

Table 3 LCG Screens Suitable for Well Depth up to 200 m

(*Clause* 8.3.3.1)

Sl No.	Nomnical Size (mm)	I.D. (mm)	O.D. (mm)	Thickness (mm)	Open Area for Different Slot Openings, (mm)								
					0.15	0.20	0.25	0.50	0.75	1.00	1.50	2.00	3.00
					Percentage Open Area								
(1)	(2)	(3)	(4)	(5)	(6)								
i)	40	40	48.7	4.4	9	12	14	25	33	40	—	—	—
ii)	50	52	61	4.4	9	12	14	25	33	40	—	—	—
iii)	75	76	88	6.0	6	8	10	18	25	30	40	47	—
iv)	100	101	113	6.0	6	8	10	18	25	30	40	47	—
v)	150	153	165	6.0	6	8	10	18	25	30	40	47	—
vi)	200	205	219	7.0	6	8	10	18	25	30	40	47	—
vii)	250	256	272	8.0	5	6	8	14	20	25	33	40	50
viii)	300	306	322	8.0	5	6	8	14	20	25	33	40	50
ix)	350	338	362	12.0	4	6	7	13	19	23	32	38	48

8.3.3.3 SS screens suitable for well depth up to 200 m as given in Table 5.

8.3.3.4 SS screens suitable for well depth up to 450 m as given in Table 6.

Table 4 LCG Screens Suitable for Well Depth up to 400 m

(*Clause* 8.3.3.2)

Sl No.	Nomnical Size (mm)	I.D. (mm)	O.D. (mm)	Thickness (mm)	Open Area for Different Slot Openings, (mm)								
					0.15	0.20	0.25	0.50	0.75	1.00	1.50	2.00	3.00
					Percentage Open Area								
(1)	(2)	(3)	(4)	(5)	(6)								
i)	150	153	167	7.0	6	8	10	18	25	30	40	47	—
ii)	200	205	221	8.0	5	6	8	14	20	25	33	40	50
iii)	250	256	276	10.0	4	6	7	13	19	23	32	38	48
iv)	300	306	326	10.0	4	6	7	13	19	23	32	38	48
v)	350	338	363	12.5	3	5	6	11	15	19	26	32	42

Table 5 SS Screens Suitable for Well Depth up to 200 m

(*Clause* 8.3.3.3)

Sl No.	Nomnical Size (mm)	I.D. (mm)	O.D. (mm)	Thickness (mm)	Open Area for Different Slot Openings, (mm)								
					0.15	0.20	0.25	0.50	0.75	1.00	1.50	2.00	3.00
					Percentage Open Area								
(1)	(2)	(3)	(4)	(5)	(6)								
i)	40	40	48.4	4.2	9	12	14	25	33	40	50	-	-
ii)	50	52	60	4.0	9	12	14	25	33	40	50	-	-
iii)	75	76	86.5	5.3	6	8	10	18	25	31	40	47	-
iv)	100	101	111	5.0	6	8	10	18	25	31	40	47	-
v)	150	153	163	5.0	6	8	10	18	25	31	40	47	-
vi)	200	205	217.5	6.3	6	8	10	18	25	30	40	47	-
vii)	250	256	271	7.3	5	6	8	14	20	25	33	40	50
viii)	300	306	322	8.0	5	6	8	14	20	25	33	40	50
ix)	350	338	358	10.0	5	7	8	15	21	26	35	41	51

Table 6 SS Screens Suitable for Well Depth up to 450 m

(*Clause* 8.3.3.4)

Sl No.	Nomnical Size (mm)	I.D. (mm)	O.D. (mm)	Thickness (mm)	Open Area for Different Slot Openings, (mm)								
					0.15	0.20	0.25	0.50	0.75	1.00	1.50	2.00	3.00
					Percentage Open Area								
(1)	(2)	(3)	(4)	(5)	(6)								
i)	150	153	165.5	6.3	6	8	10	18	25	30	40	47	-
ii)	200	205	221	8.0	5	6	8	14	20	25	33	40	50
iii)	250	256	272.5	8.2	5	7	8	15	21	26	35	41	51
iv)	300	306	320	12.0	4	5	7	11	16	20	27	33	42
v)	350	338	363.5	12.75	4	5	6	11	16	20	27	33	42

8.3.4 *Strength Parameters*

The minimum acceptable values of strength parameters shall be as follows for two classes and two materials.

8.3.4.1 LCG screens for tube well depth up to 200 m as given in Table 7.

8.3.4.2 LCG screens for tube well depth up to 400 m as given in Table 8.

8.3.4.3 SS screens for tube well depth up to 200 m as given in Table 9.

8.3.4.4 SS screens for tube well depth up to 450 m as given in Table 10.

Table 7 LCG Screens for Tube Well Depth up to 200 m

(*Clause* 8.3.4.1)

Sl No.	Nomnical Size (mm)	Collapse Pressure, MPa Slot Opening									Tensile Load (kN)
		0.15	0.20	0.25	0.50	0.75	1.00	1.50	2.00	3.00	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
i)	40	27.5	26.5	25.5	22.1	20.4	18.1	15.2	—	—	29.43
ii)	50	14.2	14.0	13.7	11.8	10.6	9.6	7.8	—	—	29.43
iii)	75	14.7	14.4	14.2	12.7	11.8	10.8	9.5	8.3	—	39.24
iv)	100	7.1	6.9	6.8	6.2	5.7	5.2	4.5	4.0	—	49.05
v)	150	2.5	2.4	2.4	2.2	2.0	1.9	1.6	1.4	—	58.86
vi)	200	1.1	1.0	1.0	0.9	0.9	0.8	0.7	0.6	—	137.34
vii)	250	1.2	1.2	1.1	1.1	1.0	1.0	0.9	0.8	0.6	176.58
viii)	300	0.7	0.7	0.7	0.6	0.6	0.5	0.5	0.4	0.4	206.01
ix)	350	1.7	1.6	1.6	1.5	1.4	1.3	1.2	1.1	0.9	461.07

Table 8 LCG Screens for Tube Well Depth up to 400 m

(*Clause* 8.3.4.2)

Sl No.	Nomnical Size (mm)	Collapse Pressure, MPa Slot Opening									Tensile Load (kN)
		0.15	0.20	0.25	0.50	0.75	1.00	1.50	2.00	3.00	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
i)	150	2.5	2.4	2.4	2.2	2.0	1.9	1.6	1.4	—	98.10
ii)	200	2.3	2.3	2.2	2.1	1.9	1.8	1.7	1.4	1.2	137.34
iii)	250	3.8	3.8	3.7	3.4	3.2	3.0	2.7	2.5	2.1	176.58
iv)	300	2.3	2.3	2.3	2.1	2.0	1.9	1.7	1.5	1.3	206.01
v)	350	1.8	1.8	1.8	1.7	1.6	1.5	1.4	1.3	1.1	461.07

Table 9 SS Screens for Tube Well Depth up to 200 m

(*Clause* 8.3.4.3)

Sl No.	Nomnical Size (mm)	Collapse Pressure, MPa Slot Opening									Tensile Load (kN)
		0.15	0.20	0.25	0.50	0.75	1.00	1.50	2.00	3.00	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
i)	40	30.2	29.4	28.4	25.0	22.1	20.1	16.7	—	—	39.24
ii)	50	15.7	15.2	14.7	12.7	11.3	10.3	8.3	—	—	39.24
iii)	75	5.6	5.4	5.2	4.7	4.4	4.0	3.4	3.0	—	49.05
iv)	100	2.6	2.6	2.5	2.3	2.1	2.0	1.7	1.5	—	78.48
v)	150	0.9	0.9	0.9	0.8	0.7	0.7	0.6	0.5	—	107.91
vi)	200	1.1	1.1	1.1	1.0	0.9	0.8	0.7	0.6	—	186.39
vii)	250	1.3	1.3	1.2	1.2	1.1	1.0	0.9	0.8	0.7	235.44
viii)	300	0.8	0.8	0.7	0.7	0.6	0.6	0.5	0.5	0.4	392.40
ix)	350	1.2	1.2	1.1	1.0	1.0	0.9	0.8	0.7	0.6	716.13

Table 10 SS Screens for Tube Well Depth up to 450 m

(*Clause* 8.3.4.4)

Sl No.	**Nomnical Size** (mm)	**Collapse Pressure, MPa** **Slot Opening**									**Tensile Load (kN)**
		0.15	0.20	0.25	0.50	0.75	1.00	1.50	2.00	3.00	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
i)	150	2.3	2.3	2.2	2.0	1.9	1.7	1.5	1.3	—	137.34
ii)	200	2.4	2.3	2.3	2.1	2.0	1.9	1.6	1.5	1.2	264.87
iii)	250	1.7	1.7	1.6	1.5	1.4	1.3	1.1	1.0	0.8	343.35
iv)	300	3.4	3.3	3.3	3.1	2.9	2.7	2.5	2.4	2.0	578.79
v)	350	2.5	2.5	2.5	2.4	2.2	2.1	1.9	1.8	1.5	716.13

8.3.5 *Tolerances*

The maximum permissible values of tolerances on dimensions shall be as given below:

Screen inner diameter (I.D)	± 1.5 percent
Screen outer diameter (O.D)	± 1.5 percent
Screen thickness	± 10 percent
End ring inner diameter (I.D)	± 1.5 percent
End ring outer diameter (O.D)	± 1.5 percent
End ring thickness	± 12.5 percent
Screen overall length	± 50 mm

Slot Opening:

Table 11 Slot Opening

(*Clause* 8.3.5)

Sl No.	**Slot Size** mm	**Tolerance** (Not Less than 70 Percent Reading) mm	**Max Deviation** (Not More than 30 Percent Readings) mm
(1)	(2)	(3)	(4)
i)	0.15	± 0.05	± 0.10
ii)	0.20	± 0.05	± 0.10
ii)	0.25	± 0.07	± 0.10
iv)	0.50	± 0.10	± 0.15
v)	0.75	± 0.10	± 0.15
vi)	1.00	± 0.15	± 0.20
vii)	1.50	± 0.15	± 0.20
viii)	2.00	± 0.30	± 0.50
ix)	3.00	± 0.30	± 0.50

8.3.6 *Inspection and Testing Procedures*

8.3.6.1 *Sampling plan*

Test	***Sampling***	
a) Type Tests	Normal size	Sample Size
i) Collapse Pressure test	Up to 100 mm	One for every 400 pipes or part thereof
	Above 100 mm and up to 300 mm	One for every 200 pipes or part thereof
	Above 300 mm	One for every 100 pipes or part thereof
ii) Tensile Strength test	Minimum number of samples per lot	Two
b) Routine Tests		
i) Visual	Each piece	
ii)Dimensional	One in ten pieces	
iii) Slot opening	One in ten pieces	
iv) Weld joint strength	One in twenty five pieces	

8.3.6.2 *Method of testing*

a) *Dimensional check* — With the help of measuring instruments to verify dimensions to be within tolerance limits.

b) *Slot opening* (*With feeler gauges*) — Slot size to be measured for all slots over 100 mm length in each metre length of screen randomly. 70 percent of the slots shall fall within the tolerance and no slot shall exceed maximum deviation.

c) *Visual checks:*
   1) There should not be any sudden change in inner diameter (I.D) or outer diameter (O.D) of screen;
   2) No profile wire or support rod shall be bent or twisted;
   3) No profile wire and support rod intersection shall be found without welding;
   4) Welding of support rods to end rings shall be uniform with each support rod;
   5) Screens shall be reasonably concentric and straight with end faces reasonably square to axis; and
   6) At the joining point of screen and end ring, there shall be no gap larger than slot opening.

d) *Collapse pressure* — Screen sample of appropriate length should be closed at one end by welding plain M.S. Plate. The screen outside surface to be wrapped with the strong plastic film to block all slots and shall be leak proof. The sample to be bolted inside bigger pressure pipe to leave an annular space of more than 25 mm radially. Hydraulic oil to be pumped in this annular space and pressure to be built up to the specified limit of collapse strength for that size. Screen sample shall not collapse at this pressure.

e) *Tensile strength* — Screen sample of appropriate length with end rings should be closed at one end by welding strong mild steel plate and flange welded at another end for bolting. The sample is to be bolted on hydraulic cylinder such that its piston pushes against the closed end. Hydraulic piston pressure is to be applied to bring screen under tension up to the specified value of tensile load as given in **8.3.4**. The screen shall not break or support rod should not loosen from end ring. Any other suitable method may also be used.

f) *Weld joint strength* — A small strip over one support rod to be cut from the end of the screen in push test apparatus, with the help of two metallic fingers the profile wire shall be pushed by hydraulic cylinder to separate it from support rod. It shall not separate at specified value of load as agreed to between the purchaser and the manufacturer.

8.3.6.3 *Criteria for conformity*

a) *Dimensional check* — All dimensions shall conform to the drawing or contract and tolerances shall be as given in **8.3.5**.

b) *Slot opening* — The actual values shall be within the tolerance limit applicable as given in **8.3.5**.

c) *Visual check* — No abnormalities shall be found.

d) *Collapse pressure* — The collapse shall not take place at collapse pressure lesser than that specified for the respective size as given in **8.3.4**.

e) *Tensile strength* — The failure shall not take place at tensile load lesser than that specified for the respective size as given in **8.3.4**.

f) *Weld joint strength* — The separation of wrapping wire and support rod shall not occur at push load lesser than that specified for the respective size as given in **8.3.6.2** (f).

8.3.6.4 *Retests of samples*

In case any one of the test pieces first selected fail to pass any of the tests specified, two further samples shall be selected for testing in respect of each failure from the same lot.

Should the test pieces from both these additional samples pass, the material represented by the test samples shall be deemed to comply with the requirement of that particular test. Should the test pieces from either of the additional samples fail, the material represented by the test samples shall be rejected.

NOTE — Weld strength requirements shall be included later as sufficient data is not available. Till such time the requirements are not included in the specification, the weld strength may be as agreed to between the manufacturer and the purchaser.

8.4 Brass Screens

8.4.1 The screens shall be manufactured from lead free brass sheets conforming to IS 3168 unless otherwise specified. The minimum thickness of the sheet shall be as given in Table 12.

Table 12 Sheet Thickness

(*Clause* 8.4.1)

Sl No.	Depth of Tubewell,	Thickness, Minimum Diameter of Screens (mm)			
	(m)	150	200	250	300
(1)	(2)	(3)	(4)	(5)	(6)
i)	Up to 100	3.2	4.5	5.4	5.4
ii)	Above 100	4.5	5.4	5.4	5.4

NOTE — Brass strips as per IS 3168 for making brass screens, in which lead (Pb) content is lower (0.05 percent to 0.10 percent) may be used.

8.4.2 Distance between slots and rows shall be as given in Fig. 5A and 5B.

8.4.3 Provision of one longitudinal joints for brass screen of length up to 2 m may be allowed.

9 GENERAL REQUIREMENTS

9.1 The screens shall possess adequate resistance to corrosion and incrustation due to chemical content of soil and water. Where water is of highly incrusting nature, the screen shall be such as to permit the water to enter the well with minimum resistance. Also, wherever incrustation commonly occurs it should be desirable to choose the material for the screen that can withstand subsequent acid treatment for removing incrustation.

9.2 The screen shall be as far as possible of single metal construction to avoid galvanic corrosion.

9.3 Well screens shall be threaded and socketed, plain bevel ended, collared or male and female types so that convenient lengths could be added. The slotted pipe screens shall have adequate strength to withstand axial, collapse and hydrostatic loads to be experienced during development and use.

10 MARKING

10.1 Each pipe shall be marked with the following details:

a) Nominal size in mm;
b) Overall length in m;
c) Manufacturer's trade-mark;
d) Grade or thickness, in mm;
e) Slot size, in mm; and
f) Material.

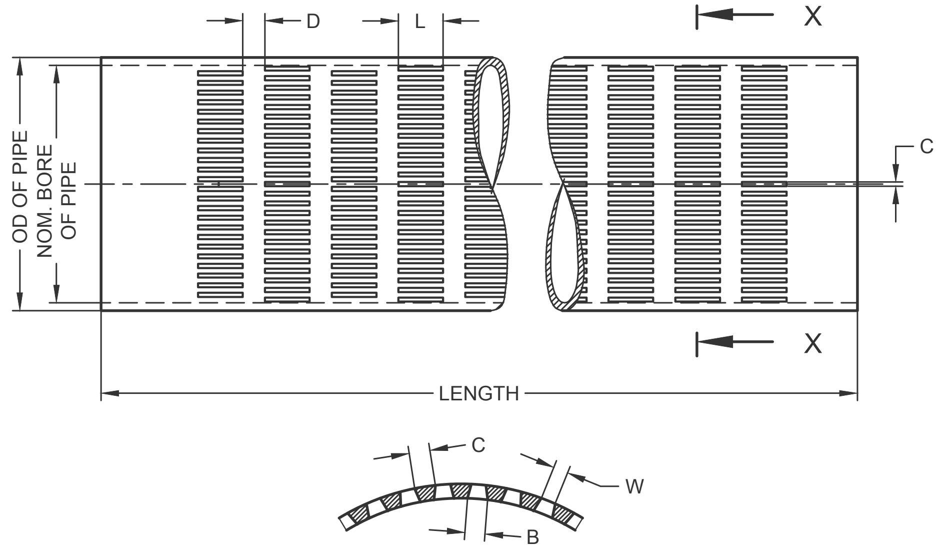
10.2 BIS Certification Marking

The water well screens and slotted pipes may also be marked with the Standard Mark.

10.2.1 The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations made thereunder, and the products may be marked with the standard mark.

11 PACKING

The water well screens and slotted pipes shall be packed as agreed to between the purchaser and the manufacturer.



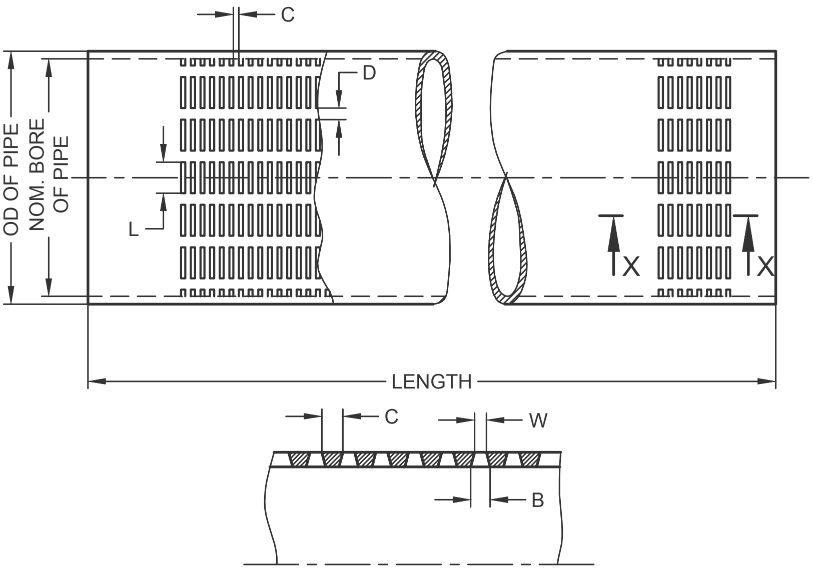
V GROOVE SECTION X X

Sl No.	NB of Pipe	OD of Pipe	Sizes of Slots		No. of Rows Per Meter	Total Slots Per Row	Area of Slots Per Metre in mm^2	Open Area Percent	*B*	Distance Between Slots	Distance Between Rows
			W	*L*						*C*	*D*
(1)	(2)	(3)	(4)	(5)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
i)	152	162	0.793	40	16	2 368	75 113	14.8	2.778	2.627	19.050
ii)	152	162	1.587	40	16	1 024	65 003	12.8	4.762	6.350	19.050
iii)	204	213	0.793	40	16	2 416	76 635	11.5	2.778	3.627	19.050
iv)	204	212	1.587	40	16	1 328	84 301	12.7	4.762	6.350	19.050

Metal — Brass sheets according to IS 3168.

All dimensions in millimetres.

FIG. 5A BRASS SCREEENS WITH VERTICAL SLOTS



V GROOVE SECTION X X

Sl No.	NB of Pipe mm	OD of Pipe	Sizes of Slots		No. of Rows Per Meter	Total Slots Per Row	Area of Slots Per Metre in mm²	Open Area Present (Percent)	*B*	Distance Between Slots	Distance Between Rows
			W	*L*						*C*	*D*
(1)	(2)	(3)	(4)	(5)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
i)	40	48.4	0.25	27	4	2283	15410.25	10.1	1.20	1.50	11
ii)	50	60.8	0.25	30	5	2853	21397.50	11.2	1.23	1.50	8.2
iii)	50	66.5	0.50	30	5	2217	33255.00	15.9	1.65	1.75	11.80
iv)	80	89	0.50	35	6	2398	41965.00	15.0	1.56	2.00	11.6
v)	80	94.5	0.75	35	6	2026	53182.50	17.9	1.60	2.20	14.50
vi)	100	115	0.50	35	8	3202	56035.00	15.5	1.56	2.00	10.1
vii)	100	121.06	0.75	35	8	2704	70980.00	18.7	1.60	2.20	12.5
viii)	152	162	0.793	30	12	2711	64494.69	12.7	2.778	3.627	12.4
ix)	152	162	1.587	30	12	1499	71367.39	14.0	4.762	6.350	12.4
x)	204	213	0.793	30	12	2713	64542.27	9.7	2.770	3.627	25.7
xi)	204	212	1.587	30	12	1883	89649.63	13.5	4.762	4.762	25.5

Metal — Brass sheets according to IS 3168.

All dimensions in millimetres.

FIG. 5B BRASS SCREEENS WITH HORIZONTAL SLOTS

FIG. 5 BRASS SCREEENS

ANNEX A

(*Clause* 8.1.2.2)

MECHANICAL PROPERTIES OF FIBRE GLASS REINFORCED PLASTIC (FRP) PIPES

A-1 THE FRP PIPES SHALL WITHSTAND THE FOLLOWING TESTS

A-1.1 Mechanical Strength

A-1.1.1 *Axial Tensile Strength*

The ultimate tensile strength of the pipe shall not be less than 102 kN or ten times the weight of a hypothetical well string comprising 18 m of upper well casing, 4 m of screen, and 6 m of lower well casing, whichever is greater.

A-1.1.2 *Axial Compression Strength*

The compressive strength of the pipe when tested in the axial direction shall not be less than 102 kN.

A-1.1.3 *Internal Hydrostatic Pressure Test*

The pipe shall withstand a hydraulic pressure of 210 N/cm^2 continuously.

A-1.1.4 *External Collapse Pressure Test*

The slotted pipes shall withstand the following external pressures:

Well Depth (*m*) *Over Up to and Including*	***Collapse Pressure,*** *N/cm*^{2}
0 - 100	28
100 - 150	49
150 - 225	70
225 - 300	84
300 - 400	98

A-1.1.5 *Water Absorption and Retention of Strength*

Water absorption in boiling water for 72 h shall be less than one percent. Strength retention after boil test shall be at least 50 percent of original strength.

NOTES

1 Axial tension and axial compression values given are based on required handling strength, chiefly from previous experience. Further the axial tensile value includes with a safety factor, the load required to withdraw the well string after gravel packing but before full development.

2 Internal hydrostatic pressure strength is based on the ability of slotted pipes to withstand cleaning by explosive of masked string of cordtex.

3 External collapse pressure is based on estimated maximum pressure likely to be experienced in development.

A-2 WELL DESIGN CRITERION

A-2.1 Screen Length

The length of screen shall be governed by the thickness of aquifer and shall be sufficient to obtain the designed specified yield from tube well. However, the minimum total length shall be such that the entrance velocity is less than the permissible entrance velocity of 0.03 m/s to ensure longer life of the well. The length of individual screen pipes shall be such as to afford easy handling for transport and lowering into wells, and removal in the case of recovery, etc. The lengths shall be such that there is minimum wastage in using of various length inside the well and to ensure that the combinations from the nearest requirement to obtain the estimated specific yield of the well. They may be in random lengths specified by the user in consultation with the manufacturer. To account for possibility of inaccuracy in strata logging, screen shall not be placed in at least 0.3 m on both sides of the granular stratum.

A-2.2 Screen Diameter

The criterion for determining the diameter of the well screen shall depend on the designed yield of the tube well. It shall be ensured that the area of opening available in the screen for flow of water, after giving allowance for possible blockage by gravel or aquifer material shall ensure a screen entrance velocity of not more than 0.03 m/s.

A-2.3 Illustration

The designed yield of a tube well is 100 m^3/h and a screen having 20 percent open area is proposed to be used in a length of 20 m to tap aquifer of 25 m thick. Diameter, of the screen is to be worked out as:

$$Q = A \times V$$

where,

Q = discharge, in m^3/s;

A = effective open area of the screen, in m^2/s; and

V = entrance velocity, in m/s (to be limited to a maximum of 0.03 m/s).

$$\text{Therefore, } \mathrm{A} = \frac{100}{3\,600} \times \frac{1}{0.03} = 0.925\,9 \text{ m}^2$$

Taking effective open area as 50 percent of that provided in all cases except wire wound screens where effective open area is 100 percent, in order to take into account the reduction of the effective area of the screen openings with time due to incrustation rearrangement of the aquifer particles around the screen and coverage by gravel, etc.

The required effective open area = 2 × 0.925 9 = 1.851 8 m^2

Effective open area of a pipe = $\pi \times d \times l \times$ percentage of open area in the screen.

Where,

d = diameter of pipe, in m; and

l = length of pipe, in m.

Therefore, $d = \dfrac{1.8518 \times 100}{\pi \times 20 \times 20} = 0.147$ m or say 147 mm

The required screen diameter works out to 147 mm.

Based on the factors of friction losses in pipe flow and availability of percent open area on most screens, the screen diameters for various discharges to be pumped from the well, are given below for general guidance:

Suggested screen diameters for various well yields

Discharge, litre/min			*Screen Diameter, mm*	
From		To	Minimum	Recommended
Up to	-	475	100	100
475	-	1 125	150	150
1 300	-	3 000	200	250
3 000	-	5 250	250	300
5 200	-	9 500	300	350

A-3 SLOT SIZE

The slot size for gravel pack shall be so selected as to retain at least 90 percent of the pack material. However, in case where well is not provided with gravel pack, slot size shall be such that it would allow 40 to 60 percent of the aquifer material to pass through.

ANNEX B

(*Foreword*)

COMMITTEE COMPOSITION

Diamond Core and Water Well Drilling Sectional Committee, MED 21

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